Chapter 5

SERE Medicine

5. SERE Medicine

Among the many things which can compromise an IP's ability to return are medical problems encountered during the isolating event. Although military members are provided with Self Aid-Buddy Care (SABC) instruction, SERE medicine addresses the use of expedient techniques which can aid survival in a field or captivity environment when more traditional methods are unavailable. An IP's situational awareness will help determine the appropriate treatment based on their situation. The procedures in this chapter must be viewed in the reality of a true isolating event. The results of treatment may be substandard when compared with present medical standards. However, these procedures will not compromise professional medical care which becomes available following recovery. Moreover, in the context of an isolating event, they may represent the best available treatment to extend the individual's life expectancy.

Figure 5-1 POW Medicine

5.1. Health PreservationSERE medicine encompasses procedures and expedients that are required and available for the preservation of health and the prevention, improvement, or treatment of injuries and illnesses encountered during an isolating event. It must also be suitable for application by nonmedical personnel to themselves or others in the circumstances of the isolating event. SERE medicine is more than first aid in the conventional sense. It approaches final

definitive treatment in that it is not dependent upon the availability of technical medical assistance within a reasonable period of time.

5.1.1. Triage in Group Survival

In a group survival situation, the methods of treating illnesses and injuries do not change but the decisions and outcomes involved may change. It may become necessary to conduct a rudimentary triage to determine if individuals have injuries that are incompatible with life. Treating these individuals may waste critical supplies and time. This waste could endanger the remaining personnel and jeopardize their chances for successful survival and evasion. Consideration should be given to the potential of having to leave critically injured, unable to move, or deceased individuals behind to insure the safety and freedom of the remaining IP (Figure 5-2). These considerations should be thought of as part of IPs pre-mission preparation and discussion.

- During Operation Gothic Serpent, Warrant Officer Michael Durant was the pilot of *Super Six Four*, the second MH-60L Black Hawk helicopter to crash during the Battle of Mogadishu on October 3, 1993. The helicopter was hit by a rocket-propelled grenade in the tail, which led to its crash about a mile southwest of the operation's target.
- Durant and his crew of three (Bill Cleveland, Ray Frank, and Tommy Field), survived the crash, though they were badly injured. Durant suffered a broken leg and a badly injured back. Two snipers, Master Sergeant Gary Gordon and Sergeant First Class Randy Shughart, had been providing suppressive fire from the air at hostile Somalis who were converging on the area. Both volunteered for insertion and fought off the advancing Somalis, killing an undetermined number, until they ran out of ammunition and were overwhelmed and killed, along with Cleveland, Frank, and Field. Both Gordon and Shughart received the Medal of Honor posthumously for this action.
- The Somalis captured Durant and held him for several days. Durant was the only one of his crew to survive. During part of Durant's time in captivity, he was cared for by Somali General Mohamed Farrah Aidid's propaganda minister Abdullahi "Firimbi" Hassan. After eleven days in captivity, Durant was released, along with a captured Nigerian soldier, to the custody of the International Committee of the Red Cross.

Figure 5-2 Survival Medicine

5.1.2. Factors that Reduce Survival Expectancy

Injuries and illnesses peculiar to certain environments can reduce survival expectancy. In cold climates, and often in an open sea survival situation, exposure to extreme cold can produce serious tissue trauma, such as frostbite, or death from hypothermia. Exposure to heat in warm climates, and in certain areas on the open seas, can produce heat cramps, heat exhaustion, or life-threatening heatstroke.

5.1.3. Loss of Gender Boundaries in a Survival Situation

Gender boundaries and social customs may need to be crossed during an isolating event. This may involve a female treating a male or male treating a female. The relationship will be of a clinical nature and could entail wound tending, feeding, and personal hygiene.

- During Desert Storm, then Major Rhonda Cornum was on a Black Hawk helicopter which was shot down on February 27, 1991. She suffered two broken arms, a broken finger, a gunshot wound in the back, and other injuries. She and two other survivors of the crash were captured by the Iraqis. After three days of being roughly shuttled from bunkers to primitive prisons, Major Cornum received medical attention. During their captivity and until their repatriation, Sergeant Troy Dunlap, a US Army Pathfinder, assisted Major Cornum, acting as her nurse and tending to her personal needs due to her inability to use her arms.

5.1.4. How Illnesses Can Interfere with a Successful Survival Situation Illnesses contracted during evasion or in a captivity environment can interfere with successful survival. Among these are gastrointestinal disorders, respiratory diseases, skin infections and infestations, malaria, typhus, cholera, etc. Captives are, in the physical sense at least, under the control of their captors. Thus, the application of SERE medicine principles will depend on the amount of medical service and supplies the captors can and are willing to give to their prisoners. An enemy may both withhold supplies and confiscate IP's supplies. Some potential enemies (even if they wanted to provide captive medical support) have such low standards of medical practice that their best efforts could jeopardize the recovery of the patient.

5.1.5. Probable Medical Injury in an IP Situation

Looking at combat recovery missions for the past five years, all IP recovered had some type of medical injury ranging from minor to major including fractures, lacerations, burns, and combat trauma. Potential IP must understand, that even in the unlikely event of ending up un-injured during the initial part of their isolating event, 10 percent of all IP have some type of injury by the time they are rescued. It is important to emphasize that even minor injuries or ailments, when ignored, become major problems in a survival situation. Thus, prompt attention to the most minor medical problem is essential in a survival episode. Applying principles of survival medicine should enable military members to maintain health and well-being until rescued and returned to friendly control.

5.2. Basic Health Care

In a survival situation, cleanliness is essential to prevent infection. Adequate personal cleanliness will not only protect against disease germs that are present in the individual's surroundings, but will also protect the group by reducing the spread of these germs.

5.2.1.1. Washing

Washing, particularly the face, hands, and feet, reduces the chances of infection from small scratches and abrasions. A daily bath or shower with hot water and soap is ideal. If a tub or shower is not available, the body should be cleaned with a cloth and soapy water, paying particular attention to the body creases (armpits, groin, etc.), face, ears, hands, and feet. After this type of "bath", the body should be rinsed thoroughly with clear water to remove all traces of soap, which could cause irritation.

5.2.1.2. Substitute when Soap is Unavailable

Soap, although an aid, is not essential to keeping clean. Ashes, sand, loamy soil, and other expedients may be used to clean the body as well as clean cooking utensils.

5.2.1.3. Air Baths When Water is in Short Supply When water is in short supply, the IP should take an "air bath." All clothing should be removed and the body simply exposed to the air. Exposure to sunshine is ideal, but even on an overcast day or indoors, a two-hour exposure of the naked body to the air will refresh the body. Care should be taken to avoid sunburn when bathing in this manner. Exposure in the shade, shelter, sleeping bag, etc., will help if the weather conditions do not permit direct exposure.

5.2.1.4. Keeping Hair Trimmed

Hair should be kept trimmed; preferably two inches or less in length, and the face should be clean-shaven. Hair provides a surface for the attachment of parasites and the growth of bacteria. Keeping the hair short and the face clean-shaven will provide fewer habitats for these organisms. At least once a week, the hair should be washed with soap and water. When water is in short supply, the hair should be combed or brushed thoroughly and covered to keep it clean. It should be inspected weekly for fleas, lice, and other parasites. When parasites are discovered, they should be removed.

5.2.1.5. Infection and Open Wounds

The principal means of infecting food and open wounds is when they come in contact with unclean hands. Hands should be washed with soap and water, if available, after handling any material which is likely to carry germs. This is especially important after each visit to the latrine, when caring for the sick and injured, and before handling food, food utensils, or drinking water. The fingers should be kept out of the mouth and the fingernails kept closely trimmed and clean. A scratch from a long fingernail could develop into a serious infection.

5.2.2. Care of the Mouth and Teeth

Application of the following fundamentals of oral hygiene will prevent tooth decay and gum disease. The mouth and teeth should be cleansed thoroughly with a toothbrush and toothpaste at least once each day. When a toothbrush is not available, a "chewing stick" can be fashioned from a twig. The twig should be washed, and then chewed on one end until it is frayed and brush-like. The teeth can then be brushed very thoroughly with the stick, taking care to clean all tooth surfaces. If necessary, a clean strip of cloth can be wrapped around the finger and rubbed on the teeth to wipe away food particles which may have collected. When neither toothpaste nor toothpowders are available, salt, soap, or baking soda can be used as a substitute. Gargling with Willow bark tea will help protect the teeth and relieve pain. Gum tissues should be stimulated by rubbing them vigorously with a clean finger each day.

5.2.2.1. Removing Food Debris

Food debris which has accumulated between the teeth should be removed by using dental floss or toothpicks. The latter can be fashioned from small twigs. Parachute inner core can be used by separating the filaments of the inner core and using this as a dental floss. Dental floss can also be improvised from fishing line.

5.2.2.2. Cleaning Dentures and Removable Bridges

Use as much care cleaning dentures and other dental appliances, removable or fixed, as when cleaning natural teeth. Dentures and removable bridges should be removed and cleaned with a denture brush or "chew stick" at least once each day. The tissue under the dentures should be brushed or rubbed regularly for proper stimulation. Removable dental appliances should be removed at night or for a two- to three-hour period during the day.

5.2.2.3. Dental Problems

Dental Problems were a common issue among captives, not only during confinement, but also before capture. Periodontitis (inflammation of tissue surrounding the tooth), pyorrhea (discharge of pus), and damage to teeth consistent with poor hygiene and "wear and tear" were also present.

5.2.2.4. Toothaches

Specific complaints such as pain associated with the common toothache represented one of the most distressing problems faced by past POWs. Along with toothaches, captives may have to deal with facial injury during egress, or caused by physical abuse during interrogation

5.2.2.5. Maintaining a Well Maintained Cleaning Program

The basic principle of maintaining a well-planned cleaning program using fiber, brushes, or branches certainly contributed to the relatively low incidence of cavities and infection among POW's. The lancing of an abscess using bamboo sticks, although not a professional maneuver has merit insofar as the pressure is relieved and the tendency to develop into cellulitis (widespread infection) decreased. The application of aspirin directly into the cavity should be discouraged. The most effective tool against dental complications in captivity is proper preventive dentistry. The present program, if adhered to, is adequate to ensure a high state of dental hygiene while captive. Dental pain/problems were a major concern mentioned by POWs after their return from captivity during the Vietnam War. Dental pain made eating what little food they received difficult, disrupted times when they were left alone by their captors, and could undermine all other activities.

5.2.3. Care of the Feet

Proper care of the feet is of utmost importance in a survival situation, especially if the IP has to travel. Serious foot trouble can be prevented by observing the following simple rules.

5.2.3.1. Washing or Air Cleaning Feet

The feet should be washed, dried thoroughly, and massaged each day. If water is in short supply, the feet should be "air cleaned" along with the rest of the body.

5.2.3.2. Trimming Toenails

Toenails should be trimmed straight across to prevent the development of ingrown toenails.

5.2.3.3. Proper Fitting and Breaking in Boots

Boots should be broken in before wearing them on any mission. They should fit properly, neither so tight that they bind and cause pressure spots nor so loose that they permit the foot to slide forward and backward when walking. Insoles can be improvised to reduce any friction spots inside the shoes.

5.2.3.4. Socks

Socks should be large enough to allow the toes to move freely but not so loose that they wrinkle. Wool socks should be at least one size larger than cotton socks to allow for shrinkage. Socks with holes should be properly darned before they are worn. Wearing socks with holes or socks that are poorly repaired may cause blisters. Clots of wool on the inside and outside should be removed from wool socks because they may cause blisters. Socks should be changed and washed thoroughly with soap and water each day. Woolen socks should be washed in cool water to lessen shrinkage and turned inside out when cleaned. In camp, freshly laundered socks should be stretched to facilitate drying by hanging in the sun or in an air current. While traveling, a damp pair of socks can be dried by placing them inside layers of clothing or securing them on the outside of the pack. If socks become damp, they should be exchanged for dry ones at the first opportunity.

5.2.3.5. Examining Feet Regularly When Traveling

When traveling, the feet should be examined regularly to see if there are any red spots or blisters. If detected in the early stages of development, tender areas should be covered with adhesive tape to prevent blister formation.

5.3. Clothing and Bedding

Clothing and bedding can become contaminated with any disease germs which may be present on the skin, in the stool, in the urine, or in secretions of the nose and throat. Therefore, keeping clothing and bedding as clean as possible will decrease the chances of skin infection and decrease the possibility of parasite infestation. Outer clothing should be washed with soap and water when it becomes soiled. Socks and under clothes should be changed daily. If water is in short supply, clothing should be "air cleaned. "For air cleaning, the clothing is shaken outside, then aired and sunned for two hours. Clothing cleaned in this manner should be worn in rotation. Sleeping bags should be turned inside out, fluffed, and aired after each use. Bed linen should be changed at least once a week, and the blankets, pillows, and mattresses should be aired and sunned (Figure 5-3).

Figure 5-3 Bedding

5.3.1. Rest

Rest is necessary for the IP because it not only restores physical and mental vigor, but also promotes healing during an illness or after an injury.

5.3.1.1. Planning Session

In the initial stage of the survival episode, rest is particularly important. After those tasks requiring immediate attention are done, the IP should inventory available resources, decide upon a plan of action, and even have a meal. This "planning session" will provide a rest period without the IP having a feeling of "doing nothing."

5.3.1.2. Planned Rest Periods

If possible, regular rest periods should be planned in each day's activities. The amount of time allotted for rest will depend on a number of factors, including the IP's physical condition, the number of IP, the presence of hostile forces, etc. Usually, 10 minutes each hour should be sufficient. During these rest periods, the IP should change either from physical activity to complete rest or from mental activity to physical activity as the case may be. The IP must learn to become comfortable and to rest under less than ideal conditions.

5.4. Illness

Many illnesses which are minor in a normal medical environment become major in a survival situation when the individual is alone without medications or medical care. IP should use standard methods (treat symptoms) to prevent expected diseases since treatment in a survival situation is so difficult. In an isolating event, whether short-term or long-term, the dangers of disease are multiplied. Key preventive methods are to maintain a current immunization record, maintain a proper diet, and exercise.

5.4.1. Personal Hygiene

Application of the following simple guidelines regarding personal hygiene will enable the IP to safeguard personal health and the health of others:

- All water obtained from natural sources should be disinfected before consumption if possible.
- The ground in the camp area should not be soiled with urine or feces. Latrines should be used. When no latrines are available, individuals should dig "cat holes" and cover their waste.
- Fingers and other contaminated objects should never be put into the mouth. Hands should be washed before handling any food or drinking water, before using the fingers in the care of the mouth and teeth, before and after caring for the sick and injured, and after handling any material likely to carry disease or germs.
- After each meal, all eating utensils should be cleaned and disinfected in boiling water.
- The mouth and teeth should be cleansed thoroughly at least once each day.
- Bites and insects can be avoided by keeping the body clean, by wearing proper protective clothing, and by using a head net, improvised bed nets, and insect repellants.
- Wet clothing should be exchanged for dry clothing as soon as possible to avoid unnecessary body heat loss. Refer to chapter 15 for more information on the care and use of clothing and equipment.

- Personal items such as canteens, pipes, towels, toothbrushes, handkerchiefs, and shaving items should not be shared with others.
- All food scraps, cans, and refuse should be removed from the camp area and buried.
- If possible, an IP should get seven or eight hours of sleep each night.

5.4.2. Food Poisoning

Food poisoning is a significant threat to IP. Due to sporadic food availability, excess foods must be preserved and saved for future consumption. Methods for food preservation vary with the global area and situation. Bacterial contamination of food sources has historically caused much more difficulty in survival situations than the ingestion of poisonous plants and animals. Similarly, dysentery or water-borne diseases can be controlled by proper sanitation and personal hygiene. If the food poisoning is due to toxins such as staphylococcus or botulism (acute symptoms of nausea, vomiting, and diarrhea soon after ingestion of the contaminated food), supportive treatment is best. Keep the patient quiet, lying down, and ensure the patient drinks substantial quantities of water. If the poisoning is due to ingestion of bacteria which grow within the body, (delayed gradual onset of same symptoms), take antibiotics (if available). In both cases, symptoms may be alleviated by frequently eating small amounts of fine, clean charcoal. In POW situations, if chalk is available, reduce it to powder, and eat to coat and soothe the intestines. Proper sanitation and personal hygiene will help prevent spreading infection to others in the party or continuing re-infection of the patient.

5.4.3. Gastrointestinal Problems

Gastrointestinal problems often occur while in captivity.

5.4.3.1. Diarrhea and Dysentery

Diarrhea and Dysentery are common ailments in captivity. Symptoms of diarrhea and dysentery include violent explosive uncontrollable discharge with possible passage of mucous and blood. They are commonly caused by ingesting contaminated food and water, poor sanitation and hygiene, viral infections, and nutritional disturbances. Treatment can involve diet restrictions (solid food denial and increased liquid intake). Restrict intake to nonirritating foods (avoid vegetables and fruits), establish hygienic standards, increase fluid intake, and, when available, use anti-diarrheal agents. Captives can use a more exotic therapeutic regimen consisting of eating cooked green bananas, tea from specific tree bark, and drinking a quarter teaspoon of ground charcoal or chalk mixed with a quart of disinfected water.

5.4.3.2. Worms and Intestinal Parasites

Worms were extremely common in captivity. Twenty-eight percent of the released prisoners in the Vietnam War indicated worms as a significant medical problem during captivity.

- Danya Curry and Heather Mercer were held as prisoners by the Taliban, ultimately being rescued by Special Forces after 9/11. After three months of captivity, Heather had been given prescription medication to get rid of worms. Half way through the six pill treatment, one night she felt a “string” resting on her tongue, when she pulled it out; it was identified as a 10” worm. Later that night more worms attempted to crawl out, later diagnoses indicated that her infestation was so severe that the worms crawled out not because of the medicine, but they had “nowhere else to go”.

5.4.3.2.1. Symptoms and Care of Worm Infestation

Seldom fatal, worms are significant, as they can lower the general resistance other illnesses of the individual. Common identifiers of worms include severe rectal itching, insomnia, and restlessness. Worms often cause gastrointestinal problems similar to those resulting from a variety of other causes. Prevention can be a simple and readily obtainable goal. Worms and intestinal parasites can be caused by undercooked or contaminated food, poor sanitation, and infected water sources. Treatments can include the ingestion of peppers which contain certain substances chemically similar to morphine. They are effective as a counter-irritant for decreasing bowel activity. Also, pumpkin seeds can be ground up and mixed with water into a "medicinal" porridge or a cup of tea made from one to two grams of thyme multiple times per day can be ingested. Lastly, shoes should be worn when possible, hands should be washed after defecation, and fingernails should be trimmed close and frequently.

5.4.4. Nutritional Deficiencies

Nutritional deficiencies are caused by a lack of a specific nutrient that the body requires. Prevention for all nutritional disease include keeping the IP in good physical condition prior to the isolating event, educate themselves on local food sources, and eating everything and anything which is not harmful to themselves (balanced diet).

5.4.4.1. Vitamin B Deficiency (Beriberi) Beriberi is a nutritional disease resulting from a deficiency of vitamin B (Thiamine). Early signs and symptoms of the disease include muscle weakness and atrophy, loss of vibratory sensation over parts of the extremities, numbness, and tingling in the feet. According to captives, Beriberi's primary manifestation was pain in the feet described as "a minor frostbite that turned to shooting pains". It is difficult to formulate a diagnosis for Beriberi. The treatment is to increase caloric intake by eating anything of value, especially items high in vitamin B such as green peas, cereal grains, and unpolished rice.

5.4.4.2. Vitamin A Deficiency

There were several reported cases of decreased vision (primarily at night) attributed to vitamin A deficiency. This problem usually occurred during periods of punishment or politically provoked action when food was withheld as part of the discipline. The condition responded well to increased caloric intake and deserves little special mention. An understanding of the transient nature of this problem and its remedial response to therapy is important.

5.4.5. Skin Diseases

Boils, fungi, heat rash, and insect bites appeared frequently and typically remain a problem throughout the captivity experience. Preventing different types of skin diseases can be simple. Common preventions include practicing sterility when handling skin conditions, cleanliness, exposure to sunlight, keeping skin dry, and getting adequate nutrition.

5.4.5.1. Lesions

Dermatological lesions are common to various prison experiences. Their importance lies not in their lethality, but for their irritant quality and the debilitating and grating effect on morale and mental health.

5.4.5.2. Fungal Infections

Fungal infections were a common skin problem for those in tropical captivity settings. As with other skin lesions, they are significant for their noxious characteristics and weakening effect on morale and mental health. Superficial fungal infections of the skin are widespread throughout the world. Their frequency among POWs reflects the favorable circumstances of captivity for cultivating fungal infections. Treatment may consist of the removal of body hair (to prevent or improve symptoms in the case of heat rash), exposure to sunlight to dry out fungal lesions, and development of effective techniques to foster body cooling and to decrease heat generation. Considerable effort should be directed at keeping the body clean.

5.4.5.3. Boils and Blisters

Boils and blisters are typically deep-seated infection that usually involves the hair follicles and adjacent subcutaneous tissue, especially parts exposed to constant irritation. Boils and blisters are typically caused by warm humid dark places, poor sanitation and hygiene, and will increase with malnutrition and exhaustion. Boils seldom appear singularly. Once present, they are disseminated by fingers, clothing, and discharges from the nose, throat, and groin. Throughout the history of POW captivity, self-treatment was practiced primarily when there was distrust of captor techniques. Prisoners would attempt to lance the boil with any sharp instrument such as a needle, wire, splinters, etc., and exude their contents by applying pressure. The area was then covered with toothpaste and when available, iodine. Modern therapy consists of hot compresses to hasten localization, and then conservative incision and drainage. Topical antibiotics and systemic antibiotics are then used. Boils increase in frequency with a decrease in resistance as seen in malnutrition and exhaustion states in a tropical environment. The application of any material or medication with a cleansing effect may be used (soaks in saline, soap, iodine, and topical antibiotics).

5.5. Injury

Injuries are possible during any isolating event. In isolating events involving captivity, it is likely that an IP will begin their captivity experience with pre-capture injuries such as burns, wounds, fractures, and lacerations as well as the possibility of other injuries occurring from the captor's physical abuse. The practice of a few simple rules will generally lead to acceptable results in wound treatment. Also, if necessary, much can be done after reintegration to correct cosmetic and functional defects that may occur during an isolating event.

5.5.1. General Management of Injuries

5.5.1.1. Bleeding

Bleeding is the first and most important concern and must be controlled as soon as possible. Controlling bleeding is important because in survival situations, replacement transfusions are not possible. Immediate Self-Aid-Buddy-Care (SABC) steps should be taken to stop the flow of blood, regardless of its source. The method used should be commensurate with the type and degree of bleeding. Most bleeding can be controlled by direct pressure on the wound and that should be the first treatment used. To control bleeding by direct pressure on the wound, sufficient pressure must be exerted to stop the bleeding, and that pressure must be maintained long enough to "seal off" the bleeding sources. It is best to apply the pressure and keep it in place for up to 20 minutes. Alternate pressing and then releasing to see if the wound is still bleeding is not desirable. Oozing blood from a wound of an extremity can be slowed or stopped by elevating the wound above the level of the heart.

5.5.1.1.1. Pressure Points to Stop Hemorrhaging

If direct pressure fails, the next line of defense would be the use of classic pressure points to stop hemorrhaging.

5.5.1.1.2. Tourniquet

The last method for controlling hemorrhage would be the tourniquet. The tourniquet should only be used as a last resort. Even in more favorable circumstances where the tourniquet can be applied as a first aid measure and left in place until trained medical personnel remove it, the tourniquet may result in the loss of a limb. The tourniquet should be used only when all other measures have failed, and it is a life and death matter. A tourniquet, when required and properly used, will save life. The basic characteristics of a tourniquet and the methods of its use are well covered in standard first aid texts; however, certain points merit emphasis in survival medicine. A tourniquet should be used only after every alternate method has been attempted. If unable to get to medical aid, after 15 to 20 minutes, the IP should gradually loosen the tourniquet. If bleeding has stopped, remove the tourniquet; if bleeding continues, reapply and leave in place. The tourniquet should be applied as near the site of the bleeding as possible, between the wound and the heart, to reduce the amount of tissue lost. NOTE: Use of a constricting band that reduces rather than stops blood flow is NOT recommended. It does not allow for venous blood return.

5.5.1.2. Pain

The control of pain accompanying disease or injury under survival situations is both difficult and essential. In addition to its morale-breaking discomfort, pain contributes to shock and makes the IP more vulnerable to enemy influences. Ideally, pain should be eliminated by the removal of the cause. However, this is not always immediately possible. Therefore, measures for the control of pain are beneficial. Position, heat, and cold can be applied alone or in conjunction with each other.

5.5.1.2.1. Position

The part of the body that is hurting should be put at rest, or at least its activity restricted as much as possible. The position selected should be the one giving the most comfort, and be the easiest to maintain. Splints and bandages may be necessary to maintain immobilization of the affected area. Elevation of the injured part, with immobilization, is particularly beneficial for throbbing type pain such as is typical of the "mashed" finger. Open wounds should be cleansed, foreign bodies removed, and a clean dressing applied to protect the wound from the air and chance contacts with environmental objects to help reduce pain.

5.5.1.2.2. Heat and Cold

Generally, the application of warmth reduces pain such as toothache, bursitis, etc. However, in some conditions, application of cold on injuries such as strains and sprains has the same effect. Warmth or cold is best applied by using water soaked rags, materials, or water filled storage bags. This works well due to water’s high specific heat. The IP can try both to determine which is most beneficial. Caution should be used when placing hot or cold materials in direct contact with skin to avoid additional injuries.

5.5.1.2.3. Pain Killers

Drugs are very effective in reducing pain. However, they are not likely to be available in the survival situation unless the IP adds them to a personal survival kit. “Natural" procedures can be an alternative to pain killers in a survival situation. If drugs are not available, there are some parts

of vegetation which can be used. For example, parts of the Willow tree have been used for their pain-relieving and fever-lowering properties for hundreds of years. The fresh bark contains salicin, a substance that chemically resembles aspirin. It temporarily relieves headache, stomachache, and other body pain. Salicin is metabolized in to salicylic acid in the human body, which is a precursor of aspirin. Boiling eight to ten six-inch stalks in two cups of water until water turns into tea will yield a pain relieving drink. Wintergreen was also traditionally used for body aches and pains as well. Boil a half a cup of leaves into a tea and ingest the tea to reduce pains. Also, the boiled bark of the magnolia tree helps relieve internal pains and fever, and has been known to stop dysentery. To be effective controlling pain, stronger narcotic drugs such as codeine and morphine are required.

5.5.1.3. Shock

In essence, shock is a circulatory reaction of the body (as a whole) to an injury (mechanical or emotional). All IP should be familiar with the signs and symptoms of shock so that the condition may be anticipated, recognized, and dealt with effectively. However, the best survival approach is to treat all moderate and severe injuries for shock. No harm will be done, and such treatment will speed recovery. Normally, fluids administered by mouth are generally prohibited in the treatment of shock following severe injury. Such fluids are poorly absorbed when given by mouth, and they may interfere with later administration of anesthesia for surgery. In survival medicine, however, the situation is different in that the treatment being given is the final treatment. IP cannot be deprived of water for long periods just because they have been injured; in fact, their recovery depends upon adequate hydration. Small amounts of warm water, warm tea, or warm coffee given frequently early in shock are beneficial if the patient is conscious, can swallow, and has no internal injuries. In later shock, fluids by mouth are less effective as they are not absorbed from the intestines. Burns, in particular, require large amounts of water to replace fluid lost from injured areas. *Alcohol should never be given to a person in shock or who may go into shock.*

5.5.2. Infections

Infection is a serious threat to the IP. In survival medicine, one must place more emphasis on the prevention and control of infection by applying techniques identified throughout this handbook. In survival or captivity, consider all breaks in the skin due to mechanical trauma contaminated, and treat appropriately. Even superficial scratches should be cleaned with soap and water and treated with antiseptics, if available.

5.5.2.1. Basic Treatment

Water is the most universally available cleaning agent, and should be (preferably) sterile. At sea level, sterilize water by placing it in a covered container and boiling it for 10 minutes. Above 3,000 feet, water should be boiled for one hour (in a covered container) to ensure adequate sterilization. The water will remain sterile and can be stored indefinitely as long as it is covered. When water is not available for cleaning wounds, the IP should consider the use of urine. Urine may well be the most nearly sterile of all fluids available and, in some cultures, is preferred for cleaning wounds. IP should use urine from the midstream of the urine flow. Antiseptics should generally not be used in wounds which go beneath the skin's surface since they may produce tissue damage which will delay healing. Open wounds must be thoroughly cleansed with disinfected water. Irrigate wounds rather than scrubbing to minimize additional damage to the tissue. Bits of debris such as clothing, plant materials, etc., should be rinsed out of wounds by pouring large amounts of water into the wounds and ensuring that even the deepest parts are clean. In a fresh

wound where bleeding has been a problem, care must be taken not to irrigate so vigorously that clots are washed away and the bleeding resumes. Allow a period of about an hour after the bleeding has been stopped before beginning irrigation with the disinfected water. Begin gently at first, removing unhealthy tissue, increasing the vigor of the irrigation over a period of time. If the wound must be cleaned, use great care to avoid doing additional damage to the wound. The wound should be left open to promote cleansing and drainage of infection.

5.5.2.2. The "Open Treatment" Method

This is the only safe way to manage survival wounds. Efforts to close open wounds by suturing or by other procedure should not be made. In fact, it may be necessary to open the wound even more to avoid entrapment or infection and to promote drainage. The term "open" does not mean that dressings should not be used. Good surgery requires that although wounds are not "closed," nerves, bone, and blood vessels should be covered with tissue. Such judgment may be beyond the capability of the IP, but protection of vital structures will aid in the recovery and ultimate function. A notable exception to "open treatment" is the early closure of facial wounds which interfere with breathing, eating, or drinking. Wounds, left open, heal by formation of infection resistant granulation tissue (proud flesh). This tissue is easily recognized by its moist red granular appearance, a good sign in any wound. Frequently, immobilization will hasten the healing of major lacerations. While in captivity, deep open wounds will become infested with maggots frequently. The natural tendency is to remove these maggots, but actually, they do a good job of cleansing a wound by removing dead tissue. Maggots may, however, damage healthy tissue when the dead tissue is removed. So the maggots should be removed if they start to affect healthy tissue.

5.5.2.3. Maggot Therapy

The scavenging activity of the maggots actually removes dead tissue. The maggots excrete a digestive fluid which liquefies the tissue proteins, which the maggots then ingest. The maggots exude calcium carbonate which alkalizes the wound and increases the destruction of bacteria and dead tissue by the body's white blood cells. The maggot's excretion also contains two chemicals which stimulate growth of healthy tissue and hasten wound healing. Excretions contain both allantoin and urea which stimulate growth of healthy tissue and hasten wound healing.

5.5.2.4. Physiological "Logistics"

Despite all precautions, some degree of infection is almost universal in survival wounds. This is the primary reason for the "open" treatment advocated above. The human body has a tremendous capacity for combating infections if it is permitted to do so. The importance of proper rest and nutrition to wound healing and infection control has been mentioned earlier. In addition, the "logistics" of the injured body part should be improved. The injury should be immobilized in a position to favor adequate circulation, both to and from the wound. Avoid constrictive clothing or bandages. Applying heat to an infected wound will further aid in mobilizing local body defense measures. Soaking the wound in lukewarm saltwater will help draw out infection and promote oozing of fluids from the wound, thereby removing toxic products. Poultices, made of clean clay, shredded tree bark with antiseptic qualities, ground grass seed, etc., will also draw out the infection.

- For bee stings and other common skin problems, use clay with disinfected water. Mix together, using only enough water to form a thick paste, and apply it on the problem area. Let the clay dry for about 20 minutes, and then rinse it off with cool disinfected water.

- For a ground seed poultice, insert the ground seed between the third and fourth layers of gauze or bandage material and close. Pour hot water over the gauze to release the flaxseed's essential oils. Set the poultice aside to cool. Apply the poultice to the wound using medical tape to secure it in place.

5.5.2.5. Drainage

Adequate natural drainage of infected areas promotes healing. Generally, wicks or drains are unnecessary. On occasion, it may be better to remove an accumulation of pus (abscess) and insert light, loose packing to ensure continuous drainage. The knife or other instrument used in making the incision for drainage must be sterilized to avoid introducing other types of organisms. The best way to sterilize in the field is with dry or moist heat.

5.5.2.6. Debridement

Debridement is the surgical removal of lacerated, devitalized, or contaminated tissue. The debridement of severe wounds may be necessary to minimize infection (particularly of the gas gangrene type) and to reduce septic (toxic) shock. In essence, debridement is the removal of foreign material and dead or dying tissue. The procedure requires skill and should only be done by nonmedical personnel in case of dire emergency. If required, follow these general rules. Dead skin must be cut away. Muscle may be trimmed back to a point where bleeding starts and gross discoloration ceases. Fat which is damaged tends to die and should be cut away. Bone and nerves should be conserved where possible and protected from further damage. Provide ample natural drainage for the potentially infected wound and delay final closure of the wound.

5.5.2.7. Sutures

On occasion, it may be necessary to suture the wound, despite the danger of infection, in order to control bleeding or increase the mobility of the patient. If a needle is available, thread may be procured from parachute lines, fabric, or clothing, and the wound closed by "suturing." If suturing is required, place the stitches individually and far enough apart to permit drainage of underlying parts. Do not worry about the cosmetic effect; just approximate the tissue. For scalp wounds, hair may be used to close after the wound is cleansed. Infection is less a danger in this area due to the rich blood supply. Remember that in most situations, it is imperative that the wound be left open and allowed to drain.

5.5.2.8. Dressings and Bandages

After cleansing, some wounds should be covered with a clean dressing. The dressing should be sterile. However, in the survival situation, any clean cloth will help to protect the wound from further infection. A proper bandage will anchor the dressing to the wound and afford further protection. Bandages should be snug enough to prevent slippage, yet not constrictive. Slight pressure will reduce discomfort in most wounds and help stop bleeding. Once in place, dressings should not be changed too frequently unless required. External soiling does not reduce the effectiveness of a dressing, and pain and some tissue damage will accompany any removal. In addition, changing dressings increases the danger of infection.

5.5.3. Lacerations

When soft tissue is split, torn, or cut, there are three primary concerns: 1) bleeding, 2) infection, and 3) healing of the wound. See bleeding section under General Management of Injuries 5.5.1.1.

5.5.3.1. Infection

Infection is the second concern when dealing with lacerations. It is extremely important that an IP take proper precaution to prevent wounds from becoming infected.

5.5.3.2. Healing

An open wound will heal by a process known as granulation. During the healing phase, the wound should be kept as clean and dry as possible. For protection, the wound may be covered with clean dressings to absorb the drainage and to prevent additional trauma to the wound. These dressings may be loosely held in place with bandages (clean material may be used for dressings and bandages). The bandages should not be tight enough to close the wound or to impair circulation. At the time of dressing change, disinfected water may be used to gently rinse the wound. The wound may then be air dried and a clean dressing applied (the old dressing may be boiled, dried, and reused). Nutritional status is interrelated with the healing process, and it is important to consume all foods available to provide the best possible opportunity for healing.

5.5.4. Fractures and Sprains

Throughout history, captive therapy was primarily that of helping each other to exercise or immobilize the injured area, and in severe cases, to provide nursing care. In survival medicine, the initial immobilization is part of the ultimate treatment. In addition, immobilization in proper position hastens healing of fractures and improves the ultimate functional result. In an isolating event, the immobilization must suffice for a relatively long period of time and permit the patient to maintain a fairly high degree of mobility. Materials for splinting and bandaging are available in most survival situations, and proper techniques are detailed in SABC.

5.5.4.1. Fractures

Bone fractures are of two general types, open and closed. The open fracture is associated with a break in the skin over the fracture site which may range all the way from a broken bone protruding through the skin to a simple puncture from a bone splinter. The general goals of fracture management are: restore the fracture to a functional alignment; immobilize the fracture to permit healing of the bone and rehabilitation.

5.5.4.1.1. Reducing Fractures

The reduction of fractures is normally beyond the scope of first aid; however, in the prolonged survival situation, the correction of bone deformities is necessary to hasten healing and obtain the greatest functional result. The best time for manipulation of a fracture is in the period immediately following the injury, before painful muscle spasms ensue (Figure 5-4). Restoring or reducing the fracture simply means realigning the pieces of bones, putting the broken ends together as close to the original position as possible. The natural ability of the body to heal a broken bone is remarkable and it is not necessary that an extremity fracture be completely straight for satisfactory healing to occur. However, in general, it is better if the broken bone ends are approximated so that they do not override. Fractures are almost always associated with muscle spasms which become stronger with time. The force of these muscle spasms tends to cause the ends of the broken bones to override one another, so the fracture should be reduced as soon as possible. To overcome the muscle spasm, force must be exerted to reestablish the length of the extremity. Traction is applied by firmly and steadily pulling on the extremity until overriding fragments of bone are brought into line (check by the other limb). If the IP is alone, the problem is complicated but not impossible. Traction can still be applied by using gravity. The distal portion of the extremity is tied to (or wedged) into the fork of a tree or similar point of fixation. The weight of the body is then allowed

to exert the necessary traction, with the joint being manipulated until the dislocation is reduced. Frequently, it is advantageous to continue traction after reduction to ensure the proper alignment of the bones. Once the ends of the bone are realigned, the force of the muscle spasm tends to hold the bones together.

Figure 5-4 Fracture

5.5.4.1.2. Immobilizing Fractures

At this point, closed fractures are ready to be immobilized, but open fractures require treatment of the soft tissue injury in the manner outlined earlier. In other words, the wound must be cleansed and dressed, and then the extremity should be immobilized. The immobilization preserves the alignment of the fracture and prevents movement of the fractured parts which would delay healing. Once the extremity is immobilized the pulse should be repeatedly checked at the farthest part of the immobilized limb to ensure circulation. For fractures of long bones of the body, it becomes important to immobilize the joints above and below the fracture site to prevent movement of the bone ends. For example, in a fracture of the mid forearm, both the wrist and the elbow should be immobilized. In immobilizing a joint, it should be fixed in a "neutral" or functional position. That is, neither completely straight nor completely flexed or bent, but in a position approximately midway between. In splinting a finger, for example, the finger should be curved to about the same position the finger would naturally assume at rest.

5.5.4.2. Sprains

An acute non-penetrating injury to a muscle or joint is best managed by applying cold as soon as possible after the injury. Icepacks or cold compresses should be used intermittently for up to 48 hours following the injury. This will minimize hemorrhage and disability. Be careful not to use snow or ice to the point where frostbite or cold injury occurs. As the injured part begins to become numb, the ice should be removed to permit re-warming of the tissues. Then the ice can be reapplied. Following a period of 48 to 72 hours, the cold treatment can be replaced by warm packs to the affected area. A "sprain or strain" may involve a wide variety of damage ranging from a

simple bruise to deep hemorrhage or actual tearing of muscle fibers, ligaments, or tendons. While it is difficult to establish specific guidelines for treatment in the absence of a specific diagnosis, in general, injuries of this type require some period of rest (immobilization) to allow healing. The period of rest is followed by a period of rehabilitation (massage and exercise) to restore function. For what appears to be a simple superficial muscle problem, a period of five to 10 days rest followed by a gradual progressive increase in exercise is desirable. Pain should be a limiting factor. If exercise produces significant pain, the exercise program should be reduced or discontinued. In captivity, it is probably safest to treat severe injuries to a major joint like a fracture with immobilization (splint, cast) for a period of four to six weeks before beginning movement of the joint.

5.5.4.3. Splints

A splint of any rigid material such as boards, branches, bamboo, metal boot insoles, or even tightly rolled newspaper may be almost as effective as plaster or mud casts. In conditions such as continuous exposure to wetness, the splint can be cared for more effectively than the plaster or mud cast. Also, in cases where there is a soft tissue wound in close proximity to the fracture, the splint method of immobilization is more desirable than a closed cast because it permits change of dressing, cleaning, and monitoring of the soft tissue injury. Improvising a splint using available materials may be done using the materials listed above or using several parallel, pliable branches, woven together with vines, cords, or parachute lines. Use care so that the extremity is not constricted when swelling follows the injury. The fracture site should be loosely wrapped with parachute, other type of cloth, or soft plant fibers. The splints can then be tied in place extending at least the entire length of the broken bone and preferably fashioned in such a way as to immobilize the joint above and below the fracture site. Splinting or immobilizing materials should be insulated to avoid heat/cold injuries as well as improve comfort (Figure 5-5). It may be necessary to preserve the mobility of the IP after reduction of the fracture. This is difficult in fractures of the lower extremities, although tree limbs may be improvised as crutches. With companions, the use of improvised litters may be possible.

Figure 5-5 Splinting

5.5.4.4. Immobilization Duration

The time required for immobilization to ensure complete healing is very difficult to estimate. It must be assumed that healing time will, in general, be prolonged. This means that for a fracture

of the upper extremity of a "non-weight bearing bone," immobilization might have to be maintained for eight weeks or more to ensure complete healing. For a fracture of the lower extremity or a "weight bearing bone," it might require 10 or more weeks of immobilization.

5.5.4.5. Swelling

While a limb is immobilized swelling is a common side effect that will need to be dealt with. Keeping the limb elevated as much as possible throughout the day to aid in circulation will help.

5.5.4.6. Rehabilitation

Following the period of immobilization and fracture healing, a program of rehabilitation is required to restore normal functioning. Muscle tone must be re-established and the range of motion of immobilized joints must be restored. In cases where joints have been immobilized, the rehabilitation program should be started with "passive range of motion exercises". This means moving the joint through a range of motion without using the muscles which are normally used to move that joint. For example, if the left wrist has been immobilized, a person would begin the rehabilitation program by using the right hand to passively move the left wrist through a range of motion which can be tolerated without pain. When some freedom of motion of the joint has been achieved, the individual should begin actively increasing that range of motion using the muscles of the joint involved. Do not be overly forceful in the exercise program. Using pain as a guideline, the exercise should not produce more than minimal discomfort. Over a period of time, the joint movement should get progressively greater until the full range of motion is restored. Also, exercises should be started to restore the tone and strength of muscles which have been immobilized. Again, pain should be the limiting point of the program and progression should not be so rapid as to produce more than a minimal amount of discomfort.

5.5.5. Burns

Burns, encountered in isolating events, pose serious problems (Figure 5-6). Burns cause severe pain, increase the probability of shock and infection, and offer an avenue for the loss of considerable body heat, fluids, and salts. Initially, cooling a small area burn (10 percent of the body or less than any single extremity) by immersing in cool water or using a cold, moist, compress will provide relief from pain. Treating larger burns with cool water is risky due to the danger of hypothermia. Covering the wound with a clean, dry, dressing of any type reduces the chance for infection. Such protection enhances the mobility of the patient and the capability for performing other vital survival functions. In burns about the face and neck, ensure the victim has an open airway. Burns of the face and hands are particularly serious in a survival situation as they interfere with the capability of IP to meet their own needs. Breaking an aloe vera leaf and spreading the internal clear gel on burns will aid in the healing process. Additionally, soaking certain barks (Willow, Oak, and Maple) in water soothes and protects burns by astringent action. This is a function of the acid content of these barks.

Figure 5-6 Burns

5.5.5.1. Maintenance of Fluids to Recover From Burns

Maintenance of body fluids and salts is essential to recover from burns. Usually the only way to administer fluids in a survival situation is by mouth; hence, the casualty should ingest sufficient water early before the nausea and vomiting of toxicity intervenes. Consuming the eyes and blood (both cooked) of animals can help restore electrolyte levels if salt tablets are not available. NOTE: The IP may also pack salt in personal survival kits to replace electrolytes (one quarter (1/4) teaspoon per quart of water).

5.5.6. Head Injuries

Injuries to the head pose additional problems related to brain damage as well as interfering with breathing and eating. Bleeding is more profuse in the face and head area, but infections have more difficulty in taking hold. This makes it somewhat safer to close such wounds earlier to maintain function. Cricothyroidotomy may be necessary if breathing becomes difficult due to obstruction of the upper airways. In the event of unconsciousness, watch the patient closely and keep him or her still. Even in the face of mild or impending shock, keep the head level or even slightly elevated if there is reason to expect brain damage. Do not give fluids or morphine to unconscious persons.

5.5.6.1. Performing a Cricothyroidotomy

Often, the safest and fastest method to establish a surgical airway is to perform a cricothyroidotomy. In this procedure, the cricothyroid membrane is opened to allow air to pass through into the trachea. The cricothyroid membrane is the soft spot just below the Adam's apple (thyroid cartilage) and just above the cricoid cartilage. In men, this is easily identified by running your finger down the center of the neck. Just beyond the Adam's apple the cricothyroid membrane is a small, soft indentation about the width of your finger.

5.5.6.2. Locating the Cricothyroid Membrane

The thyroid cartilage (Adam's apple) in women is not usually as prominent as it is in men. It is easier to find their cricothyroid membrane by sliding your finger up the midline of the neck to the

first hard bump. That is the cricoid cartilage. Above the cartilage is the cricothyroid membrane (your target), and above the membrane is the thyroid cartilage. Practice identifying the cricothyroid membrane in your own neck, and in other personnel. Then, in an emergency, you will have no difficulty finding it.

5.5.6.3. Tools Needed to Perform a Cricothyroidotomy

To perform an emergency cricothyroidotomy, a sharp instrument, is needed. The following provides examples of instruments that can be used:

- Scalpel
- Pocket knife
- Scissors
- Razor blade
- Sharp edge of a tin can
- Broken glass

5.5.6.4. Speed is Necessary for Performing a Cricothyroidotomy

Ideally, this procedure is performed by well-trained and experienced medical personnel, using sterile technique and instruments designed for this purpose. In other than ideal conditions, speed is more important than sterile technique, special instruments or experience. In an operational setting, if the casualty needs a surgical airway, go ahead and do it, and do it quickly. Some of the most successful airway rescues have been performed by inexperienced, minimally-trained personnel, who have never done this before. There typically won't be time for any anesthetic, but that is not normally an issue since the people on whom you would be doing this procedure will be unconscious. Bleeding usually is not a problem because there are no large blood vessels either in the skin or beneath the skin in this area. Whatever device you use to keep the airway open, try to find some adhesive tape to hold it in place, without obstructing air flow. An emergency cricothyroidotomy can be left in place for up to 72 hours, but after that, it should be replaced by a tracheotomy, placed lower in the trachea by trained surgeons.

5.5.6.4.1. Cricothyroidotomy Procedure

Here is the process for performing this procedure:

1. Identify the cricothyroid membrane with your index finger.
2. Make a transverse incision using any available sharp object, directly over the cricothyroid membrane. The incision should be about an inch long.
3. Once through the skin, feel with your index finger for the soft, compressible cricothyroid membrane.
4. Take your sharp object and push it straight down through the cricothyroid membrane. There will be a distinct "pop" as you open the trachea. Don't worry about going too deep. The far side of the trachea at this point is made of very tough cartilage and it's not too easy to go all the way through it.
5. Once through the membrane, withdraw your sharp instrument and replace it with a hollow tube to keep the airway open.

6. Ideally, this hollow tube would be an endotracheal tube, but any tube-like structure will work fine. Examples include:
   - Ball point pen barrel
   - Nail clipper
   - Two keys
   - One key turned sideways
   - Bent paper clip

5.5.7. Abdominal Wounds

Wounds of the abdomen are particularly serious in a survival situation and the IP must seek immediate medical attention. Such wounds, without immediate and adequate surgery, have an extremely high mortality rate and render patients totally unable to care for themselves. If intestines are not extruded through the wound, a secure bandage should be applied to keep this from occurring. If the intestine is extruded, do not replace it due to the almost certain threat of fatal peritonitis. Cover the extruded bowel with a large dressing and keep the dressing wet with any drinkable fluid or if drinkable fluid is unavailable, then urine may be used. The IP should lie on their back and avoid any motions that increase intra-abdominal pressure which might extrude the bowels even more. Keep the IP in an immobile state or move on a litter. "Nature" will eventually take care of the problem either through death, or walling-off of the damaged area.

5.5.8. Chest Injuries

Injuries of the chest are common, painful, and disabling. In the case of a flail chest, ribs broken away from the sternum, apply a bulky dressing and wrap to immobilize. Severe bruises of the chest or fractures of the ribs may require that the chest be immobilized to prevent large painful movements of the chest wall. If a bandage is required, apply it while the patient deeply exhales. In an isolating event, it may be necessary for IP to wrap their own chest. This is more difficult but can be done by attaching one end of the long bandage (parachute material) to a tree or other fixed object, holding the other end in the hand, and slowly rolling body toward the tree, keeping enough counter pressure on the bandage to ensure a tight fit.

5.5.8.1. Sucking Chest Wounds

These wounds are easily recognized by the sucking noise and appearance of foam or bubbles in the wound. These wounds must be closed immediately before serious respiratory and circulatory complications occur. Ideally, the patient should attempt to exhale while holding the mouth and nose closed (Valsalva) as the wound is closed. This inflates the lungs and reduces the air trapped in the pleural cavity. This procedure may need to be repeated if symptoms return or worsen. Frequently, a taped, airtight dressing is all that is needed, but sometimes it is necessary to suture the wound to make sure the wound is closed.

5.5.9. Eye Injuries

Eye injuries are quite serious in a survival situation due to pain and interference with other survival functions. The techniques for removing foreign bodies and for treating snow blindness are covered in SABC. With more serious eye injuries involving disruption of the contents of the orbit or impaled objects additional steps may be required (note: Do not remove an object that is impaled

in the eye unless required for IP survival). A protective covering could be made from a bandage, cup, or similar item to protect the eye from further injury and movement. This will require the unaffected eye be covered and a vertical slit placed in the covering to reduce sympathetic eye movement. As a last resort IP may consider removing the impaled object and risk losing the eye. The IP may need to tape the lid of the affected eye closed to prevent infection (Figure 5-7).

Figure 5-7 Eye Injuries

5.5.10. Thorns and Splinters

Thorns and splinters are frequently encountered in survival situations. Reduce their danger by wearing gloves and proper footgear. Their prompt removal is quite important to prevent infection. Wounds made by these agents can be quite deep compared to their width which increases chances of infection by those organisms (such as tetanus) which grow best in the absence of oxygen. Removal of splinters is aided by the availability of a sharp instrument (needle or knife), needle nose pliers, or tweezers. Take care to get all of the foreign body out; sometimes it is best to open the wound sufficiently to properly cleanse it and to allow air to enter the wound. When cleaned, treat as any other wound.

5.5.11. Blisters and Abrasions

Care for blisters and abrasions promptly. If redness or pain is noted, the IP should stop what they are currently doing (if at all possible) to find and correct the cause. Frequently, a protective dressing or bandage and/or adhesive will be sufficient to prevent a blister. If a blister occurs, do not remove the top. Apply a sterile (or clean) dressing. Small abrasions should receive attention to prevent infection. Using soap with a mild antiseptic will minimize the infection of small abrasions which may not come to the attention of the IP.

Figure 5-8 Blisters and Abrasions

5.5.12. Insect Bites

Bites from insects, leeches, ticks, chiggers, etc., pose several hazards. Many of these organisms transmit diseases, and the bite itself is likely to become infected, especially if it itches and the IP scratches it. The body should be inspected frequently for ticks, leeches, etc., and these should be removed immediately. If appropriate and possible, the IP should avoid infested areas. These parasites can best be removed by applying heat, irritants, or petroleum jelly to them or their entrance hole to encourage a relaxation of their hold on the host. Then the entire organism may be gently detached from the skin, without leaving parts of the head imbedded. Treat such wounds as any other wound. Applying cold wet dressings will reduce itching, scratching, and swelling.

5.6. Environmental Injury

5.6.1. Dehydration

Dehydration is the lack of adequate body fluids for the body to carry on normal functions at an optimal level (brought on by loss, inadequate intake, or a combination of both). Fluid losses up to five percent are considered mild, up to ten percent are considered moderate, and up to fifteen percent are considered severe. Severe dehydration can result in seizures, permanent brain damage, cardiovascular collapse and death if not treated quickly. To prevent dehydration, drink water and ration your sweat, not your water. Common causes and symptoms of dehydration include, but are not limited to excessive loss of fluid through vomiting or excessive urine, stools or sweating, poor intake of fluids, sunken eyes, dry or sticky mucus membrane in the mouth, lack of skins normal elasticity, decreased or absent urine output, and decreased tears. If an IP shows signs of dehydration, treatment includes oral rehydration which may be sufficient for mild dehydration. Intravenous fluids and hospitalization may be necessary for moderate to severe dehydration.

5.6.2. Heat Related Injuries

5.6.2.1. Preventing Heat Related Injuries

By sweating, breathing, shivering, and shifting the flow of blood between the skin and internal organs, the body can usually keep its temperature within a narrow range in hot or cold weather.

However, overexposure to high temperatures can result in heat disorders such as heat exhaustion, heatstroke, and heat cramps. The risk of heat disorders is increased by high humidity, which decreases the cooling effect of sweating, and by prolonged strenuous exertion, which increases the amount of heat produced by the muscles. Sweat is the body's main system for getting rid of extra heat. When an IP sweats, and the water evaporates from the skin, the heat that evaporates the sweat comes mainly from the skin. As long as blood is flowing properly to the skin, extra heat from the body's core is "pumped" to the skin and removed by sweat evaporation. If a person does not sweat enough, they cannot get rid of extra heat well, and you also can't get rid of heat as well if blood is not flowing to the skin. Dehydration will make it harder for you to cool in two ways: if you are dehydrated you won't sweat as much, and the body will try to keep blood away from the skin in order to keep blood pressure at the right level in the core of your body. Since people lose water when they sweat, they must make up that water to keep from becoming dehydrated. If the air is humid, it is harder for sweat to evaporate -- this means that the body cannot get rid of extra heat when it is muggy as it can when it is relatively dry. The best fluid to drink when a person is sweating is water. Using common sense is the best way to prevent heat-related illnesses. Stay well hydrated; to make sure that the body can get rid of extra heat, and be sensible about exertion. It's also important to be sensible about how much a person exerts themselves in hot weather. The hotter and more humid it is, the harder it will be for a person (IP) to get rid of excess heat. Clothing also makes a difference. Use clothing to protect from the sun/heat and aid in keeping the body cool. Many layers of clothing may hide heavy sweating, masking symptoms of heat disorders.

5.6.2.2. Heat Cramps

Heat cramps are severe muscle spasms resulting from heavy sweating during exertion in extreme heat. Heat cramps are caused by the excessive loss of fluids and salts (electrolytes)--including sodium, potassium, and magnesium--resulting from heavy sweating. Heat cramps often begin suddenly in the hands, calves, or feet. They are often painful and disabling. The muscles become hard, tense, and difficult to relax. Heat cramps can be prevented or treated by drinking beverages or eating foods that contain sodium (salt), potassium, and magnesium such as fiddlehead ferns, crickets nuts (acorn and pine work best), and fruits.

5.6.2.3. Heat Exhaustion

Heat exhaustion is a condition resulting from exposure to heat for many hours, in which excessive loss of fluids from heavy sweating leads to fatigue, low blood pressure, and sometimes collapse. Exposure to high temperatures can cause the loss of too much fluid through sweating, particularly during hard physical labor or exercise. Salts (electrolytes) are lost with the fluids, disturbing the circulation and the brain's functioning. As a result, heat exhaustion may develop. The major symptoms of heat exhaustion are increased fatigue, weakness, anxiety, and drenching sweats. A person may feel faint when standing still because blood collects (pools) in blood vessels of the legs, which are dilated by the heat. Also, the heartbeat becomes slow and weak, the skin becomes cold, pale, and clammy, and the IP may become confused. The loss of fluids reduces the volume of blood, lowers blood pressure, and may cause the person to collapse or faint. Usually, heat exhaustion can be diagnosed on the basis of the symptoms. The main treatment is replacing fluids (rehydration) and salt. Lying flat or with the head lower than the rest of the body and sipping cool, slightly salty beverages every few minutes are generally all that is needed. Moving to a cool environment helps. After rehydration, a person often recovers rapidly and fully. If blood pressure remains low and the pulse remains slow for more than an hour despite this treatment, another condition should be suspected, diagnosed and treated.

5.6.2.4. Heat Stroke

Heatstroke is a life-threatening condition resulting from long, extreme exposure to heat, in which a person cannot sweat enough to lower body temperature. This condition often develops rapidly and requires immediate intensive treatment. If a person reaches this state, body temperature may rise to dangerously high levels, causing heatstroke. Heatstroke may develop rapidly and is not always preceded by warning signs such as a headache, vertigo (a whirling sensation), or fatigue. If a person has suffered a heat stroke, sweating usually but not always decreases. The skin is hot, flushed, and unusually dry. The heart rate increases and may quickly reach 160 to 180 beats per minute, in contrast to the normal rate of 60 to 100 beats per minute. The breathing rate usually increases, but blood pressure rarely changes. Body temperature (which should be measured rectally), rises rapidly to 104° F. to 106° F., causing a feeling of burning up. A person may become disoriented and confused and can quickly lose consciousness or have convulsions. Heatstroke can cause permanent damage or death if not treated immediately. A temperature of 106° F is very serious; a temperature just one degree higher is often fatal. Permanent damage to internal organs, such as the brain, can occur quickly, often resulting in death. Heatstroke is an emergency, and lifesaving measures should be started immediately. A person who can't be taken to a hospital quickly should be wrapped in wet bedding or clothing, immersed in a lake, stream, pond, or river. Pay attention to their body temperature (through their signs and symptoms) to avoid overcooling. After severe heatstroke, rest is advised for a few days to avoid other possible complications to include heart failure. Body temperature may fluctuate abnormally for weeks causing the potential for other environmental injuries.

5.6.3. Cold Related Injuries

5.6.3.1. Preventing Cold Related Injuries

The four main factors that make an IP more susceptible to localized cold injury are inadequate insulation from cold or wind, restricted circulation, fatigue, and poor nutrition.

5.6.3.1.1. Inadequate Insulation from Cold or Wind

The easiest and most effective way to prevent the body from losing heat is the proper wear of clothing. Keep the head and ears covered. IP will lose as much as 50 percent of their total body heat from an unprotected head at 50°F. When exerting the body, prevent perspiration by clothing at the neck and wrists and loosening it at the waist. If the body is still warm, comfort can be obtained by removing the inner layers of clothing, one layer at a time. The outer protective layer should be worn unless it is too bulky and a factor in causing the body to overheat. When work stops, the individual should put the clothing on again to prevent chilling. Change and dry wet clothing throughout the day.

5.6.3.1.2. Restricting Circulation

Avoid restricting the circulation. Clothing should not be worn so tight that it restricts the flow of blood that distributes the body heat and helps prevent cold injuries.

5.6.3.1.3. Fatigue

When a person is severely fatigued his body generates less heat. This is why it is extremely important that when in cold environment to take more rest breaks and drink plenty of water during these breaks. Once the body is overworked it is very difficult to gain the strength back. IP should take their time accomplishing tasks (like building shelters) and stay hydrated.

5.6.3.1.4. Poor Nutrition

The amount and type of food IPs eat in cold environment directly affects the amount of heat generated by the body. A large portion of an IPs diet should consist of fats. The energy contained in fats is more slowly released that the energy in carbohydrates. Because of this, it is a longer lasting form of energy.

5.6.3.2. Hypothermia

Literally, hypothermia means "low temperature" and is diagnosed when the inner (core) temperature of the body falls below 95°F (35°C). Generalized, progressive cooling of the body results in hypothermia. It can develop quickly. The body can usually tolerate a drop of a few degrees of internal body temperature. Below 90°F, the body loses its ability to regulate its temperature and to generate body heat. Progressive loss of body heat then begins. Hypothermia occurs when the core temperature is between 90 and 95°F. Hypothermia is a silent killer of those who are not prepared to face a cool, wet day. It happens when your body is not able to make enough heat to replace the warmth you lose to the environment around you.

5.6.3.2.1. Mild Hypothermia

Even mild degrees of hypothermia can have serious consequences and complications. Involuntary shivering begins in response to a drop in the body core temperature. The patient is usually alert and shivering. Shivering is an attempt to generate more heat through muscular activity. Shivering usually stops once the core temperature drops below 90º - 92ºF (30º - 31ºC). That is an indication of extreme danger. Warming the skin of someone with hypothermia may stop the shivering, even though the core temperature has not changed.

5.6.3.2.2. Additional Symptoms of Hypothermia

As the IP begins to sink farther into hypothermia they will have the additional symptoms of clumsiness and mental confusion (i.e., slowing of thought and action). If left untreated they become unconscious. Eventually all cardio-respiratory activity may cease and the patient may appear dead. Never assume a patient that is cold and without a pulse is dead.

5.6.3.2.3. Proper Emergency Measures

Patients can survive even after severe hypothermia if you carry out proper emergency measures. First, prevent further body heat loss, and then try to warm the victim. If outdoors, place the victim out of the wind in the best shelter possible. Change the victim into dry clothes, if possible, and place on top of as much insulation as possible to keep the victim off the ground. Placing a hypothermic person in a cold sleeping bag is not sufficient. The bag should be pre-warmed by another person, if possible, to transfer a maximum amount of body heat to the bag. If the bag is large enough, it can be a lifesaving step to put both people in together (two non-hypothermic people to one hypothermic person is the best ratio). If unconscious, place the victim on his/her side to ensure an open air passage. If the victim is conscious, administer warm fluids such as tea or broth. Sweets should be given if the victim is able to eat; they are quickly transformed into heat and energy. Never use alcoholic beverages as a way to re-warm a hypothermic individual.

5.6.3.3. Frostbite

Frostbite is literally the freezing of body tissue; usually skin (Figure 5-9). Fingers, toes, ears, and the nose are the area's most vulnerable to frostbite. There are two degrees of frostbite which an

IP should be concerned about. The first is Frostnip, which usually affects skin on the face, ears, or fingertips. Frostnip may cause tingling, numbness, and/or blue-white skin color for a short time (with normal feeling and color returning quickly when re-warmed). No permanent tissue damage occurs. The second is deep frostbite, in which the skin and underlying tissue freezes, looking pale or blue and feels cold, numb, and stiff or rubbery to the touch. Permanent damage is possible, depending on how long and how deeply the tissue is frozen.

5.6.3.3.1. Symptoms of Frostbite

Frostbite is caused by either prolonged exposure to cold temperatures or shorter exposure to very cold temperatures. Many people with frostnip or frostbite experience numbness. A "pins and needles" sensation, severe pain, itching, and burning are all common when the affected area is warmed and blood starts flowing again. Skin may look white, grayish-yellow, or even black with severe frostbite, and it may feel hard, waxy, and numb. Blistering is also common.

5.6.3.3.2. Treating Frostbite

Keep the affected part elevated in order to reduce swelling. Move to a warm area to prevent further heat loss. NOTE: Many people with frostbite may be experiencing hypothermia. Saving their lives is more important than preserving a finger or foot. Remove all constrictive jewelry and clothes because they may further block blood flow. Give the person warm, nonalcoholic, non-caffeinated fluids to drink.

5.6.3.3.3. Frostnip

In cases of frostnip re-warm the IP by putting the injured area against warm areas of the body to re-warm (i.e., frostnip fingers in the armpit). With frostbite, never re-warm an affected area if there is any chance it may freeze again. This thaw-refreeze cycle is very harmful and leads to disastrous results. Also, avoid a gradual thaw. The most effective method is to re-warm the area quickly. Therefore, keep the injured part away from sources of heat until a proper re-warming can take place.

5.6.3.3.4. What to do Once the Area is Re-Warmed

Once the area is re-warmed, apply a dry, sterile bandage, place cotton between any involved fingers or toes (to prevent rubbing). Do not rub the frozen area with snow (or anything else, for that matter). The friction created by this technique will only cause further tissue damage. Above all, keep in mind that the final amount of tissue destruction is proportional to the time it remains frozen, not to the absolute temperature to which it was exposed. Therefore, the act of re-warming and avoiding refreezing are critical. After re-warming, treatment of the affected parts includes leaving blisters intact, elevation of the affected parts, and using any Ibuprofen as indicated.

Figure 5-9 Frostbite

5.6.3.4. Trench Foot or Immersion Foot

Trench foot (immersion foot) is a cold injury that occurs gradually over several days of exposure to cold, but not freezing, temperatures. The name comes from World War I troops who developed symptoms after standing in cold, wet trenches. Symptoms of trench foot include red wrinkling skin that turns pale, swelling, numbness or burning pain, leg cramps, slow or absent pulse in the foot, and the development of blisters or ulcers after two to seven days, but no actual freezing of the skin. For immersion foot, remove wet shoes, boots, and socks. Re-warm the affected areas (do not use heat from a fire to dry feet), relieving pain, protecting it from further cold exposure, and preventing problems such as infection or dead skin (gangrene).

Figure 5-10 Trench Foot or Immersion Foot

5.6.4. Bites and Stings

5.6.4.1. Prevention

Prevention is the key to treatment. Follow these simple rules to reduce the chance of accidental bites and stings:

- Don't put your hand into dark places such as rock crevices, heavy brush, or hollow logs without first investigating. When crossing over debris, look to see what is on the other side.
- Look where you are stepping (especially in heavy brush or tall grass).
- Use extra caution when walking at night.
- Don't pick up any insect if you are not sure if it is venomous.
- Don't pick up freshly killed snakes without severing the head (dead snakes can still bite).
- Check all clothing and bedding before using.

5.6.4.2. Snakebites

No single physical characteristic distinguishes a poisonous snake from a harmless one except the presence of poison fangs and glands. A determination of the presence of fangs and glands safely can only be made when the snake is dead. When in doubt, treat a snake bite as if it poisonous.

5.6.4.2.1. Hemotoxic Venom Types

Some examples of these types of snakes are the copperhead, common adder, puff adder, sand viper, bushmaster, cottonmouth, and eastern/western diamondback rattlesnake. This type of venom affects the circulatory system, destroying blood cells, damaging skin tissue and causing internal hemorrhaging. Local effects include strong pain, swelling and necrosis at the site. Pain is much like that of a severe burn. Systemic effects include hemorrhaging, internal organ breakdown and destroying of blood cells. Signs and symptoms of a hemotoxic snakebite are: fang marks (can be one or more), purplish discoloration around site (developing within two to three hours after bite), numbness and possible blistering around the bite, nausea/vomiting, rapid heartbeat, low blood pressure, weakness and fainting, headache, dimmed vision, convulsions, excessive sweating, fever with chills, muscular twitching, and the entire extremity generally swells within eight to thirty-six hours.

5.6.4.2.2. Neurotoxic Venom Types

Some examples of these types of snakes are the coral snake, death adder, common cobra, Egyptian cobra, king cobra, green mamba, sea snakes, and krait. This type of venom affects the nervous system making the victim unable to breath. Local effects include little to no pain or swelling and possible necrosis. Systemic effects include respiratory collapse. Signs and symptoms of a neurotoxic snakebite are: fang marks or small scratches such (as in the case of a coral snake), little to no pain or swelling (if pain does occur it is confined to the bite area), blurred vision, drooping eyelids, slurred speech, increased salivation/sweating, drowsiness, difficulty breathing, paralysis, convulsions, nausea, and coma. Neurotoxic venom effects might not develop for one to eight hours after the bite.

5.6.4.2.3. Neurotoxic and Hemotoxic Venom Types

The venom of the Gabon viper, rhinoceros viper, tropical rattlesnake, and Mojave rattlesnake are both strongly neurotoxic and hemotoxic.

5.6.4.2.4. Snake Bite Treatment

- What to do if bitten by a venomous snake. If bitten by a venomous snake, it is important to do the following:
  - Remain calm (this is critical to reduce the spread of venom throughout the body).
  - Keep the extremity at heart level.
  - Disinfect the puncture wound, immobilize the extremity (be aware of swelling that can complicate splinting).
  - Limit movement.
  - Remove any restrictive items such as watches, rings, and boots.
  - Treat for shock.
  - Use an extractor kit if available.
- What not to do if bitten by a venomous snake. If bitten by a venomous snake, it is important **not** to:
  - Make incisions across each fang bite.
  - Apply mouth suction.
  - Use ice on the bite.
  - Place a tourniquet on the bitten extremity, or
  - Kill the snake for identification.

5.6.4.3. Spider Bites and Scorpion Stings

Signs and symptoms of a black widow (Figure 5-11) and funnel web spider bites are a pinprick sensation at the site of the bite, becoming a dull ache within thirty to forty minutes. Expect pain and spasms in the shoulder, back, chest, and abdominal muscles within thirty minutes to three hours after the bite. The IP may develop a rigid, board-like abdomen. They will usually become nauseous (with vomiting), restlessness, anxious, and start running a fever and may also develop a rash.

5.6.4.3.1. Brown Recluse Spider

Signs and symptoms of a brown recluse spider (Figure 5-11) bite are mild transitory stinging at the time of the bite, but there is little associated early pain. After two to eight hours, pain will occur varying from mild to severe. Several days later, an ulcer may form at the site of the bite. The bite may also produce serious systemic symptoms including fever, chills, weakness vomiting, joint pain, and a spotty skin eruption, all occurring within 24-48 hours after the venom injection. Scorpion bites will usually involve a sharp pain at the sting site. There will be swelling and discoloration at the sting site, which spreads gradually. Other signs and symptoms may include increased salivation, restlessness, poor coordination, seizures, incontinence, and nausea/ vomiting.

- General treatment for bites and stings is simple. The individual should remain calm. Disinfect the puncture site and in the case of a black widow, funnel web spider, and scorpions bites apply a cold compress to the puncture site if possible. Guard against infection and treat symptomatically and for shock.

Figure 5-11 Black Widow and Brown Recluse

5.6.5. Contact Skin (Dermatitis) Irritation

Common plants that cause skin irritation are poison ivy, poison oak, and poison sumac, but other plants can cause stinging, irritation, or an allergic reaction. Irritant contact, the most common type, involves inflammation resulting from contact with acids or alkaline materials. The reaction may resemble a burn. Allergic contact is caused by exposure to a substance or material to which you have become extra sensitive or allergic. The allergic reaction is often delayed, with the rash appearing 24 - 48 hours after exposure. The skin inflammation varies from mild irritation and redness to open sores, depending on the type of irritant, the body part affected, and your sensitivity.

5.6.5.1. Preventing Skin Irritation

To prevent skin irritation, avoid contact. Use protective gloves and keep sleeves rolled down with other barriers if contact with substances is likely or unavoidable. Wash skin surfaces thoroughly after contact with substances. Avoid over treating skin disorders. Symptoms of skin irritation include itching (pruritus) of the skin in exposed areas, skin redness or inflammation in the exposed area, tenderness of the skin in the exposed area, localized swelling of the skin, warmth of the exposed area, or skin lesions or rash at the site of exposure. Skin lesions which may consist of redness, rash, papules (pimple-like), vesicles, or bullae (blisters) may involve oozing, draining, or crusting and may become scaly, raw or thickened.

5.6.5.2. Initial Treatment

Initial treatment includes thorough washing with lots of water to remove any trace of the irritant that may remain on the skin. You should avoid further exposure to known irritants or allergens. In some cases, the best treatment is to do nothing to the area. Use of tannic acid “tea” poured on to the affected area may reduce some of the symptoms. Jewelweed is known for its ability to counter poison ivy and skin rashes. Jewelweed has been used as a poultice and salve. It is also used for bruises, burns, cuts, eczema, insect bites, sores, sprains, warts, and ringworm. Jewelweed is a smooth annual plant that can grow three to five feet. Trumpet-like shaped flowers hang from the plant in yellow or orange flowers with dark red dots. The Spotted Jewelweed variety is most commonly used for rashes although the Pale Jewelweed may also have medicinal properties.

5.6.5.3. Jewelweed

Jewelweed blooms May through October in the eastern part of North America from Southern Canada to the northern part of Florida. It is found most often in moist woods growing on the edges of creek beds. Slice the stem of the jewelweed plant (Figure 5-12), and then rub its juicy inside on exposed parts. This will promptly ease irritation and usually prevents breakout for most people.

Figure 5-12 Jewelweed Plant

5.7. Marine Animals that Bite

5.7.1. Sharks

Sharks live in almost all oceans, seas, and in river mouths. Sharks vary greatly in size, however, there is no correlation between the size of a shark and the risk of attack (Figure 5-13).

5.7.1.1. Behavior of Hungry Sharks

Hungry sharks sometimes follow fish up to the surface and into shallow waters along the shore. When sharks explore such waters, they are more likely to come in contact with people. Sharks seem to feed most actively during the night and particularly at dusk and dawn. After dark, they show an increased tendency to move toward the surface and into shore waters. Evidence indicates that a shark first locates food by smell or sound. Such things as garbage, body wastes, and blood probably stimulate the desire for food. A shark is also attracted by weak fluttery movements similar to those of a wounded fish. While a shark will investigate any large floating object as a possible food source, it probably will not attack a human unless it is hungry. Often the shark will swim away after investigating. At other times, it may approach and circle the object once or twice, or it may swim close and nudge the object with its snout. People on rafts are relatively safe unless they dangle their hands, arms, feet or legs in the water.

5.7.1.2. Preventing Shark Attack

Individuals on or in the water should keep a sharp lookout for sharks. Clothing and shoes should be worn. If sharks have been noticed, IP must be especially careful of the methods in which body wastes are eliminated and must avoid dumping blood and garbage. Vomiting, when it cannot be prevented should be done into a container or hand and thrown down current as far away as possible. The sea anchor can also be pulled from the water for a short period of time to move away.

5.7.1.2.1. What to do if Threatened by a Shark

If a group in the water is threatened or attacked by a shark, they should bunch together, form a tight circle, and face outward so an approaching shark can be seen. Ward off an attack by kicking or stiff-arming the shark. Striking with the bare hand should be used only as a last resort. Instead, survivors should use a hard and heavy object. During World War II the USS Indianapolis with 1,196 personnel on board was torpedoed by a Japanese submarine. Approximately 900 officers and sailors made it into the water alive before the ship sank twelve minutes later. Shark attacks began with sunrise on the first day and continued until the men were physically removed from the water. The survivors were not rescued until five days later by US Navy Sea Planes. When the survivors were recovered, only 317 remained alive.

5.7.1.3. Staying Quiet when Faced with Threatened by a Shark

Individuals should stay as quiet as possible and float to save energy and swim only if required to get to raft, land, or recovery.

- Do not swim directly away from the shark, but face the shark and swim to one side, with strong rhythmic movements.
- If a shark threatens to attack or damage a raft, jabbing the snout or gills with an oar or other hard object may discourage it. Check for sharks around and under the raft before going into the water.

Figure 5-13 Sharks

5.7.2. Barracuda

There are approximately 20 species of barracuda. Some are more feared in certain parts of the world than are sharks. If IP come down in any tropical or subtropical sea, they may encounter this fish. Barracuda are attracted by anything which enters the water and they seem to be particularly curious about bright objects. Accordingly, IP should avoid dangling dog tags or other shiny pieces of equipment in the water. Dark colored clothing is also best to wear in the water if no raft is available.

5.7.3. Moray Eels

If attacked by some species of moray eel, the IP may have to cut off their heads since some eels will retain their sharp crushing grip until dead. The knife used to do this should be very sharp since their skin is tough and difficult to cut. Their bodies are very slippery and hard to hold. An IP is most likely to come into contact with a moray eel when poking into holes and crevices around or under coral reefs. Use caution in these areas.

5.8. Marine Animals that Sting

Poisonous and Venomous Marine Animals (invertebrates). There are many marine animals that have no backbone and can inflict injuries by stinging.

5.8.1. Coelenterates

This group includes jellyfish, hydroids, sea anemones, and corals. Coelenterates are all simple, many-celled organisms. They all possess tentacles equipped with stinging cells or nematocysts in addition to other technical characteristics.

5.8.1.1. Corals

IP should treat coral cuts by thoroughly cleaning the wound and removing any coral particles. Some coral cuts have been helped by painting them with an antiseptic solution of tincture of iodine.

5.8.1.2. Sea Anemones

The sea anemone is one of the most plentiful marine creatures, with well over 1,000 species. Most of the stinging cells of the sea anemones are located on the outer ring of the tentacles.

5.8.1.3. Venom Apparatus of Coelenterates

All of the coelenterates have stinging cells or nematocysts located on the tentacles. Each of these cells is like a capsule. If the IP comes into contact with the capsule, part of it springs open and a very sharp, extremely small "thread"-type tube appears. The sharp tip of the tube penetrates the skin and the venom is injected. When coming in contact with the tentacles of any coelenterate, the IP brushes up against literally thousands of these small-stinging organs.

5.8.1.3.1. Symptoms of Stings

The symptoms produced by coelenterate stings will vary according to species, where the sting is located, and the physical condition of the IP. In general, though, the sting caused by hydroids and hydroid corals is primarily skin irritations of a local nature. Stings of the Portuguese Man-of-War may be very painful. True corals and sea anemones produce a similar reaction. Some of the sting of these organisms may be hardly noticeable, while others may cause death in three to eight minutes. Symptoms common to all of these may vary from an immediate mild prickly or stinging sensation, like that of touching a nettle, to a burning, throbbing, shooting-type pain which may

cause the survivor to become unconscious. In some cases, the pain may be localized, while in others, it may spread to the groin, armpits, or abdomen. The area in which contact was made will usually become red, followed by severe inflammation, rash, swelling, blistering, skin hemorrhages, and sometimes ulceration. In severe cases of reaction, in addition to shock, the person may experience one or more of the following: muscular cramps, lack of touch and temperature sensations, nausea, vomiting, backache, loss of speech, constriction of the throat, frothing at the mouth, delirium, paralysis, convulsions, and death. Since some of these traits appear quickly, the victim should try to get out of the water if at all possible to avoid drowning.

5.8.1.3.2. Jellyfish

One of the most deadly jellyfish is the sea wasp (an uncommon creature which is found in tropical southern Pacific waters) (Figure 5-14). This animal can cause death anywhere from 30 seconds to three hours after contact. Most deaths take place within 15 minutes. The pain is said to be excruciating. The sea wasp can be recognized by the long tentacles that hang down from the four corners of its square shaped body.

Figure 5-14 Sea Wasp Jellyfish

5.8.1.3.3. Relieve Pain

Tentacles or other matter on the skin should be removed immediately. This is important because as long as this matter is on the skin, additional stinging cells may be discharged. Use clothing, seaweed, or any other available material to remove the matter. DO NOT rub the wound with anything, especially sand, as this may cause the stinging cells to be activated. DO NOT suck the wound.

5.8.1.3.4. Alleviating the Effects of Poison

Alleviate poison effects. The following local remedies have been used in various parts of the world with varying degrees of success: papain (protein destroying enzyme) from the Papaya plant, soap, diluted ammonia solution or urine, (Urine - with its ammonia content - may be the only source of relief available to an IP).

5.8.1.3.5. The Potential need to Perform CPR

Artificial respiration and cardiopulmonary resuscitation may be required. There are no known specific antidotes for most coelenterate stings. However, there is one anti venom for the sea wasp which is papain, a proteolysis enzyme in the juice of the green fruit of the papaya. Even if the IP is in an area where the anti venom is available, it may be too late to obtain and use it. The venom acts so quickly that medical help is often too late.

5.9. Marine Animals that Puncture

5.9.1. Mollusks Octopus, squid, and univalve shellfish are in this category. Mollusks make up the largest single group of biotoxic marine invertebrates of direct importance to the IP. Stinging or venomous mollusks which concern the IP fall mainly into two categories:

5.9.1.1. Gastropoda (Stomach Footers)

These in general are un-segmented invertebrates. Sometimes their soft bodies will secrete a calcareous shell. They have a muscular foot which serves a variety of functions. Some breathe by means of a type of siphon while others use gills. Some types have jaws. In those that don't have jaws, food is obtained by a rasp-like device called a radula. In the cone shells, the radula is a barb or tooth (a hollow, needle-like structure).

- These univalves include marine snails, slugs, as well as land and freshwater snails. It is estimated that there are over 33,000 living species of gastropods. However, only members of the genus conus are of concern to the IP. Of these cone shells, there are over 400 species, but they will only be discussed in general terms with the emphasis placed on the more dangerous species. With few exceptions, these attractive shellfish are located in tropical or subtropical areas. All of these shells have a very highly developed venom apparatus designed for vertebrate or invertebrate creatures and are found from shallow tidal areas to depths of many hundreds of feet. The area in which the IP may come into contact with these shellfish is in coral reefs and sandy or rubble habitat. All cone-shaped shells in these areas should be avoided. Cone shells are usually nocturnal. During the daytime, they burrow and hide in the sand, rocks, or coral; they feed at night on worms, octopus, other gastropods, and small fish. Several of these shells have caused death in humans. The venom apparatus lies within a body cavity of the animal and the animal is capable of thrusting and injecting the poison via the barb into the flesh of the victim. The cone shell is able to inflict its wound only when the head of the animal is out of the shell.
- The sting made by a cone shell is a puncture-type wound. The area around the wound may exhibit one or more of the following: turning blue, swelling, numbness, stinging, or burning sensation. The amount of pain will vary from person to person. Some say the pain is like a bee sting, while others find it unbearable. The numbness and tingling sensations around the site of the wound may spread rapidly, involving the whole body, especially around the lips and mouth. Complete general muscle paralysis may occur. Coma may ensue and death is usually the result of cardiac failure.

- The pain comes from the injection of venom, slime, and other irritating foreign matter into the wound site. The treatment is primarily symptomatic because there is no specific treatment. Applying hot towels or soaking the affected area in hot water may relieve some of the pain. Artificial respiration may be needed.
- This group includes the nautili, squid, cuttlefish, and octopus. Since the octopus is the marine animal most likely to be encountered by an IP, it is the only one that will be discussed. The head of this animal is large and contains well-developed eyes. The mouth is surrounded by eight legs equipped with many suckers. It can move rapidly by expelling water from its body cavity, though it usually glides or creeps over the bottom. Most octopuses live in water ranging from very shallow to depths of over 100 fathoms. All are carnivorous and feed on crabs, and other mollusks. Octopuses like to hide in holes or underwater caves-avoid these areas. The small blue ring octopus is usually only three or four inches across although some may be slightly larger. Found throughout the Indo-Pacific area, this octopus is not aggressive toward humans. Because its venomous bite is so dangerous, it should not be handled at any time. When this animal is disturbed the intensity of its blue rings varies rapidly on a light yellow or cream to brown background (Figure 5-15).
- The sharp parrot-like beak of the octopus makes two small puncture wounds into which a toxic solution or venom is injected. Pain is usually felt immediately in the form of a burning, itching, or stinging sensation. Bleeding from the wound is usually very profuse which may indicate the venom contains an anticoagulant. In some cases, the area around the wound and the entire appendage, may swell, turn red, and feel hot.

Figure 5-15 Blue Ringed Octopus

5.9.1.1.1. Treatment

Treat for shock, stop bleeding, clean the wound area since more venomous saliva could be in the area, and treat symptoms as they arise. There is no known cure for the venom of the Blue Ringed octopus.

5.9.2. Echinoderms

Sea cucumbers, starfish, and sea urchins are members of this group. Sea urchins comprise the most dangerous type of echinoderms. Sea urchins have rounded, egg-shaped, or flattened bodies. They have hard shells that carry spines. In some species, the spines are venomous and present a hazard if stepped on or handled. Some urchins are nocturnal. They all tend to be omnivorous, eating algae, mollusks, and other small organisms. They can be found in tidal pools or in areas of great depth in many parts of the world. Sea urchins are not good food sources. At certain times of the year, certain species can be poisonous.

5.9.2.1. Complications

The needle-sharp points of sea urchin spines are able to penetrate the flesh easily. These spines are also very brittle and tend to break off while still attached to the wound and are very difficult to withdraw. Stepping on one of these spines produces an immediate and very intense burning sensation. The area of pain will also swell, turn red, and ache. Numbness and muscular paralysis, swelling of the face, and a change in the pulse have also been reported. Secondary infection usually sets in. While some deaths have been reported, other victims have experienced loss of speech, respiratory distress, and paralysis. The paralysis will last from 15 minutes to six hours.

5.9.2.2. Treatment

Spines that are detached from the animal will continue to secrete venom into the wound. The spines of some species will be easily dislodged whereas others must be surgically removed. There will also be some discoloration due to a dye the animal secretes -- do not be disturbed by this. Some experts say to apply grease to allow the spines to be scraped off. Others advise leaving them alone since some of the spines will dissolve in the wound within 24 to 48 hours. Still other experts say to apply citrus juice, if available, or soak the area in vinegar several times a day to dissolve them.

5.9.2.3. Prevention

No sea urchin should be handled. The spines can penetrate leather and canvas with ease.

5.9.3. Venomous Spine Fish (Fish That Sting)

Types of fish in this group are Stingrays (includes whip rays, bat rays, butterfly rays, cow-nosed rays, and round stingrays), Rat fish, Catfish, Scorpion fish, Surgeon fish and Star Gazers (Figure 5-16 and Figure 5-17). NOTE: For all wounds from these types of fish, aid should be directed to three areas: alleviating the pain of the sting, trying to halt the effects of the venom, and preventing infection.

5.9.3.1. Pain Inflicted by Fish That Sting

Certain types of these fish have up to 18 spines. The pain caused by the sting of one of these spines is so great in some species that the victim may scream and thrash about wildly. In one case, a man stung in the face by a weever fish begged for bystanders to shoot him, even after two shots of morphine sulfate. Many of these fish are bottom dwellers who will not move out of the way when being approached by humans. Instead, they will lie quietly camouflaged, put up their spines, and simply wait for the unlucky individual to step on them. Other people have been injured by them while trying to remove them from fishing nets and fishing lines.

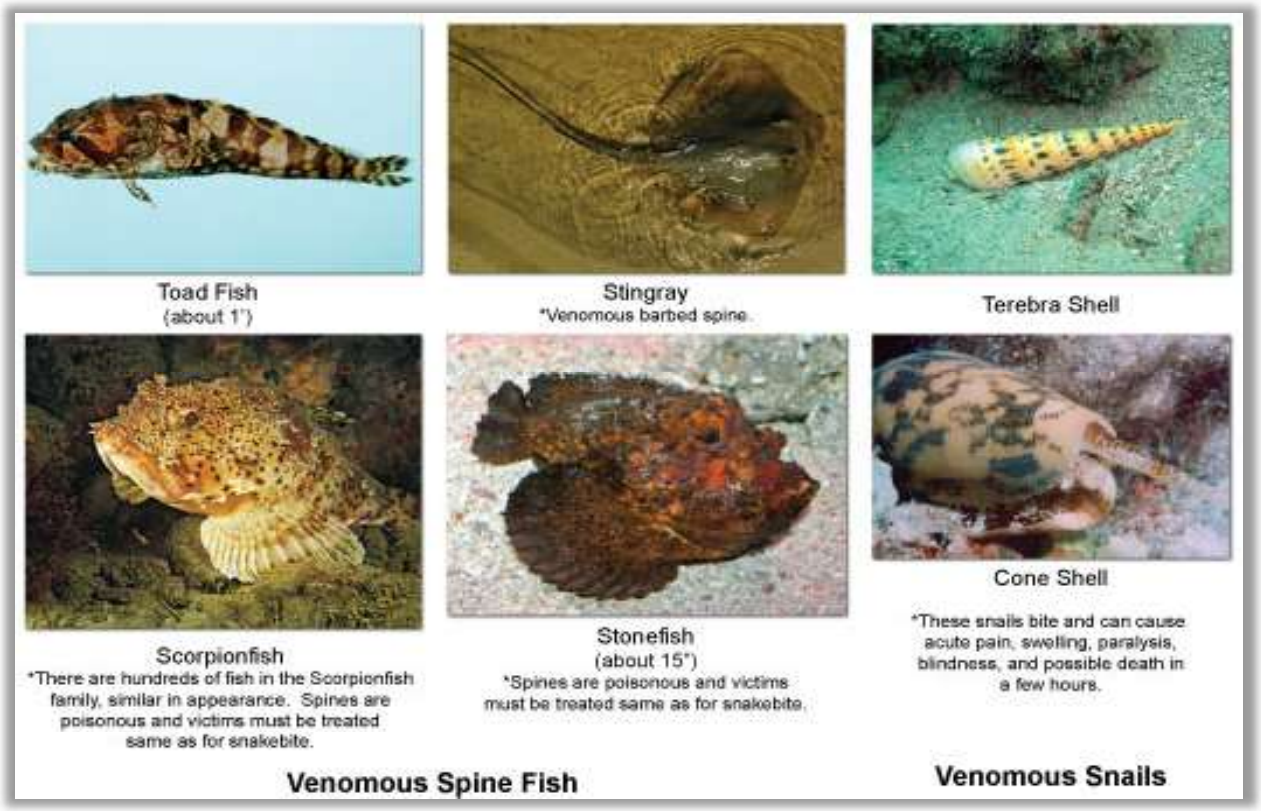
Toad Fish
(about 1')
Stingray
*Venomous barbed spine
Terebra Shell
Scorpionfish
*There are hundreds of fish in the Scorpionfish family, similar in appearance. Spines are poisonous and victims must be treated same as for snakebite.
Stonefish
(about 15")
*Spines are poisonous and victims must be treated same as for snakebite.
Cone Shell
*These snails bite and can cause acute pain, swelling, paralysis, blindness, and possible death in a few hours.
Venomous Spine Fish
Venomous Snails

Figure 5-16 Venomous Spine Fish and Snails

5.9.3.2. How to Remove the Barb of a Stingray

In cases where humans are stung by stingrays, the barbs on the sharp spines may cause severe lacerations as well as introduce poison. These wounds should be irrigated without delay. Puncture wounds from the fish are small and make removal of the poison a difficult process. It may be necessary to remove the barb. A procedure which is fairly successful is to make a small cut across the wound (debride) and then apply suction. Even if no incision is made, suction should be tried since it is important to remove as much of the venom as possible. The more poison removed, the better. Morphine does not relieve the pain of some of these venoms.

5.9.3.3. Treating the Sting Injury

Most doctors agree that the injured part should be soaked in hot water from 30 minutes to one hour. The temperature of the water should be as hot as the patient can stand without injury. If the wound is on the face or body, hot moist cloth compresses can be used. The use of heat in this manner may weaken the effect of the poison in some cases. After soaking the wound, clean it again, if necessary. Cover the area of the wound with antiseptic and a clean sterile dressing. If antibiotics are available, it may be advisable to use them to help prevent infection. Treatment for shock is wise. Artificial respiration may be needed since different types of venom may cause cardiac failure, convulsions, or respiratory distress.

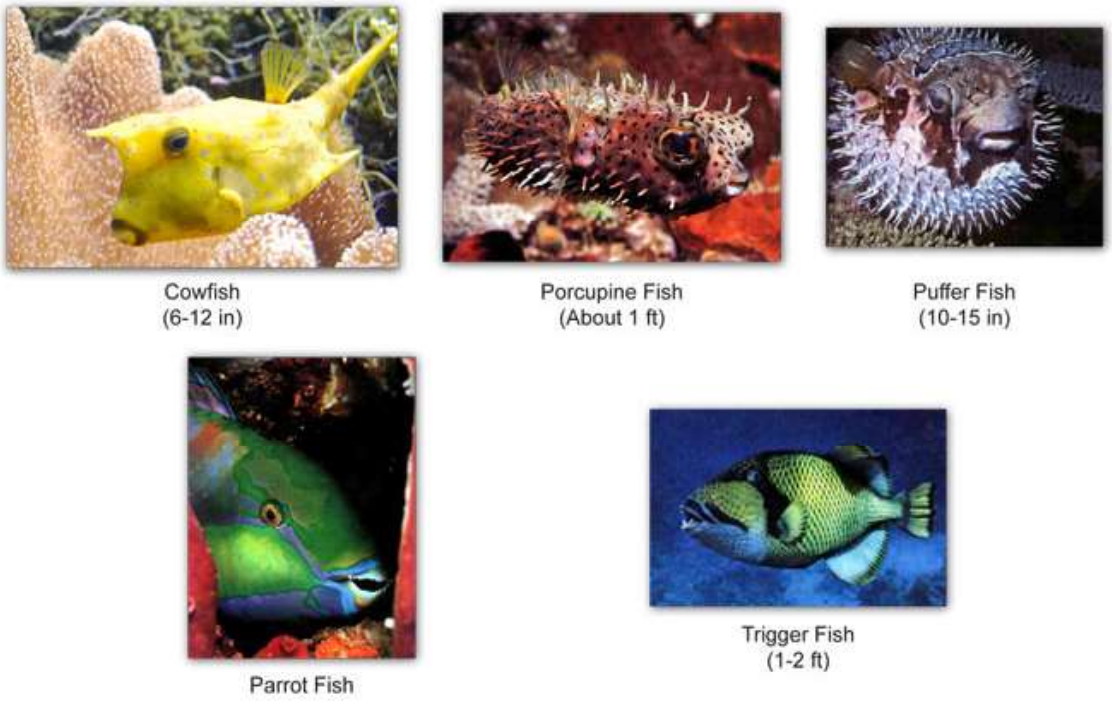

Figure 5-17 Fish With Poisonous Flesh

5.9.3.4. Treatment

As soon as any symptoms arise, vomiting should be induced by administering warm saltwater or the whites of eggs. If these procedures don't work, try sticking a finger down the person's throat. A laxative should also be given to the victim if one is available. The victim may have to be protected from injury during convulsions. If the victim complains of severe itching, cool showers may give some relief. Treat any other symptoms as they arise.

5.10. Medical Plants for SERE Scenarios

The Encyclopedia of Herbal Medicine (Chevallier, 2000) suggests that over the course of time, some 70,000 plant species have been used in the practice of medicine; the Chinese Pharmacopeia lists over 5,700 remedies that are mostly of plant origins. With the sheer volume of plants, the topic of herbal medicine can easily be overwhelming. Never the less, by applying a few guidelines, the information can benefit the potential IP. Plants to be used in SERE must be common, easily identified, readily obtainable and they should not have poisonous mimics in nature. They must be safe to use, have minimal side effects, and a high therapeutic index. Finally, the potential IP must know how to prepare and use medicinal plants or they have no value. The potential IP can learn medicinal plants that are available in most regions of the world (global in nature) and/or those medicinal plants native to the deployment location. Plants a potential IP learns should also treat symptoms of conditions (illnesses, wounds, and/or injuries) that are common for the most expected types of isolating event. The following list obtained from *The Encyclopedia of Herbal Medicine* (Chevalier, 2000), contains examples of plants that meet the criteria noted above.

5.10.1. Aloe Vera

Aloe Vera gel directly extracted from the leaf can be applied to treat burns, eczema, and other skin conditions (Figure 5-18).

Figure 5-18 Aloe Vera

5.10.2. Peppers

Cayenne Chili and other pepper species contain capsaicin. Oil infused with peppers can be massaged into the skin to relieve aching muscles and joints. Peppers have expectorant properties that help with congestion; eating them can also help eliminate intestinal parasites (Figure 5-19).

Figure 5-19 Cayenne Chili

5.10.3. Common Plantain

Common Plantain has several medicinal uses. Leaves can be macerated and applied to the skin to stop bleeding or promote wound healing. As an infusion (tea) it can aid in the treatment of diarrhea and gastritis. Plantain is also and expectorant/decongestant similar to Mullein (Figure 5-20).

Figure 5-20 Common Plantain

5.10.4. Dandelion

Dandelion is a great source of vitamins and all parts are edible. Dandelion has diuretic and detoxifying properties. Decoctions are a liquid medicine made from an extract of water-soluble substances, usually with the aid of boiling water. Herbal remedies or decoctions can be made from the root of the Dandelion to treat several skin conditions, arthritis, and constipation (Figure 5-21).

Figure 5-21 Dandelion

5.10.5. Dog Rose

Dog Rose, besides being vitamin rich, tea made from rose hips is used to treat diarrhea (Figure 5-22).

Figure 5-22 Dog Rose

5.10.6. Garlic

Garlic also treats multiple ailments. The juice from the bulbs can be mixed with water and used as an antiseptic to treat skin infections. Garlic cloves can be eaten to treat coughs and bronchitis (Figure 5-23).

Figure 5-23 Garlic

5.10.7. Mullein Leaves

Mullein leaves and flowers make a good expectorant for treating coughs and congestion when infused into a tea. The Aloe-like emollient in the leaves can be applied directly to skin wounds (Figure 5-24).

Figure 5-24 Mullein

5.10.8. Onions

Onions have diuretic, expectorant, anti-inflammatory, analgesic, antibiotic, and anti-rheumatic properties. Onions can be eaten or the juice applied topically; they also prevent oral infections and fight tooth decay (Figure 5-25).

Figure 5-25 Onions

5.10.9. White Willow

White Willow and Black Willow barks contain salicylic acid, a substance that chemically resembles aspirin. It temporarily relieves headache, stomachache, and other body pain. Salicin is metabolized into salicylic acid in the human body, which is a precursor of aspirin. White Willow has anti-inflammatory, analgesic, anti-pyretic, anti-rheumatic, and astringent properties; it can be prepared into a decoction (Figure 5-26).

Figure 5-26 White Willow

5.10.10. Yarrow

Yarrow made into a poultice can help treat wounds. In tea form, Yarrow helps with upper-respiratory infections, indigestion, and to regulate menses. All parts of the plant can be used (Figure 5-27).

Figure 5-27 Yarrow

5.10.11. Sweet Gum

Sweet Gum was traditionally used as incense and medicine well before settlers came to the Americas. The tree produces a light brown sap from the inner bark and wood, which is similar in color to honey from the inner bark and wood. Water from boiled Sweet Gum leaves can also be used as antiseptic for wounds (Figure 5-28).

Figure 5-28 Sweet Gum

5.10.12. Balsam

Balsam tree's boiled down sap is often used to cure dysentery, diarrhea diphtheria, and pulmonic catarrhs. When the balsam is combined with tallow or lard it becomes highly effective at curing skin problems. This mixture has been used to cure skin problems like ringworm. The medicinal properties of the balsam come from extractives found inside it. Cinnamyl cinnamate, ethyl, benzyl, and other forms of cinnamic acid are some of the extractives found in the balsam.

5.10.13. Preparing Plants for Medical Use

As previously stated, identifying plants with medicinal properties is only part of the equation. The potential IP must have some basic instruction on preparation and use. The following is a list of general guidelines for making herbal remedies (Chevallier, 2000).

5.10.13.1. Herbal Teas

Infusions (herbal teas) are made by steeping dried or fresh herbs (about one to two teaspoons for each cup [8 oz.] of water) for 10 minutes in boiling water then straining.

5.10.13.2. Macerations

Macerations are essentially infusions that are made by soaking the herbs in cold water versus boiling. Mixtures are allowed to sit overnight in a cool place and then strained.

5.10.13.3. Decoctions

Decoctions are also similar to infusions, but the process is used for tougher plant material such as roots, barks, seeds, berries, and stems. The plant matter is chopped into thin pieces. Approximately one to two teaspoons of herbs (dried or fresh) is added to 20 ounces of water and

brought to a boil. The mixture is allowed to simmer until the volume has reduced by about one-third and then strained.

5.10.13.4. Infused Oils

Infused oils can be prepared by hot or cold methods. Any kind of vegetable oil (olive, canola, sesame, and almond) will work. With cold infusion, the herbs and oil are placed in a jar and allowed to sit for three to four weeks. The hot infusion method involves cooking the mixture over low heat for three to four hours. The mixtures are strained at the end of both processes.

5.10.13.5. Ointments

Ointments are made by adding three to four ounces of infused oil to a small amount (approximately a one inch cube) of melted beeswax. The mixture will thicken to the correct consistency once it cools.

5.10.13.6. Poultices

Poultices are ground herbs that are made into a paste with a small amount of water. The mixture is placed on a piece of gauze and then on the affected area of skin. The poultice is secured with a bandage and can be left in place for up to 24 hours.

5.11. Conclusions

When managing an IP's trauma during an isolating event, remember that the body will do the healing or repairing, and the purpose of the "treater" is to provide the body with the best possible atmosphere to conduct that self-repair. Some general principles include:

- Be in the best possible physical, emotional, and nutritional status before being exposed to a potential survival or captivity setting.
- Minimize the risk of injury at the time of survival or captivity by following appropriate safety procedures and properly using protective equipment.
- Maintain the best possible nutritional status while in captivity or the survival setting.
- Don't over treat!!! Overly vigorous treatment can do more harm than good.
- Use cold applications for relief of pain and to minimize disability from burns and soft tissue strains or sprains.
- Clean all wounds by gentle irrigation with large amounts of the cleanest water available.
- Leave wounds open.
- Splint fractures in a functional position.
- After the bone has healed, begin an exercise program to restore function.
- Remember that even improperly healed wounds or fractures may be improved by cosmetic or rehabilitative surgery and treatment upon rescue or repatriation.
- Common sense and basic understanding of the type of injuries are most helpful in avoiding complication and debilitation. Adequate nourishment and maintenance of physical condition will materially assist healing of burns, fractures, lacerations, and other injuries-the body will repair itself.